

DECEMBER 2019 Update

5G Millimeter Wave Forecast Update

Major changes to the forecast over the last three months include:

1. Table 1-1: The number of RU units deployed to the field is coming as we predicted last time, at about 90,000 total for 2019. We have adjusted the number slightly to account for delays in the manufacturing/testing process to get these RUs into the field... the manufacturing cycle appears to be longer than the normal cycle for RRH units below 6 GHz.
2. Table 1-2: We've adjusted the breakdown of RUs by frequency band based on the usage by AT&T and T-Mobile compared with Verizon. Verizon appears to be the most aggressive in deployment in the mm-wave bands, mostly in the 28 GHz band.
3. Table 1-3: The number of RU units deployed in Japan is higher than expected in the last quarter of 2019, with Rakuten deploying significant numbers at a rapid pace. We've adjusted the proportion of 2019 shipments to APAC accordingly.
4. Table 1-4: While Verizon continues to push for high downlink EIRP, AT&T and T-Mobile are not as keen on high downlink power, noting that the uplink is the limitation anyway. We have adjusted our breakdown of "low power" and "high power" RUs to reflect a higher number of units below the defining line of +53 dBm linear EIRP. Many operators now appear willing to accept an outdoor deployment that is line-of-sight only at lower power.
5. Table 1-6: We've adjusted our profile of 64T, 256T, and 1024T configurations to stay consistent with the view that lower power units will use 64 elements and higher number of elements will be used in the high-power case.
6. Table 2-2: We have adjusted the number of broadband device shipments based on our recent survey of retail stores in the Chicago market. Based on a series of interviews with retail sales clerks, we believe that about 220,000 5G mm-wave devices will have sold by Dec 2019.
7. Table 2-2: Over the longer term we are gaining optimism for the mm-wave market. Over the last three months we have seen some silicon and GaAs/GaN solutions that will bring HUGE improvements to the performance of the 5G mm-wave uplink. As a result we have increased our longer term forecast for handsets.
8. Table 2-3: The market is still primarily focused on handsets, not hotspots. As a result we have adjusted our 2019 and 2020 estimates for broadband devices to reflect more handsets

and fewer hotspots. We have left the long-term trend toward hotspots in place for now, and we're still watching to see how this trend turns out.

9. Table 2-4: We've reduced our expectations for handset shipments in Japan during 2019... no commercial launches yet so we have simply listed a few units in 2019 for beta testing.